Hollifield, and Chuck White of The Boeing Co. GSA-23F-0183K, Order No. NNK04MB84D.

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KSC-12712

Advanced Reference Counting Pointers for Better Performance

A computer program implements reference counting pointers (RCPs) that are lock-free, thread-safe, async-safe, and operational on a multiprocessor computer. RCPs are powerful and convenient means of managing heap memory in C++ software. Most prior RCP programs use locks to ensure thread safety and manage concurrency. The present program was developed in a continuing effort to explore ways of using the C++ programming language to develop safety-critical and mission-critical software.

This effort includes exploration of lock-free algorithms because they offer potential to avoid some costly and difficult verification problems. Unlike previously published RCP software, the present program does not use locks (meaning that no thread can block progress on another thread): Instead, this program implements algorithms that exploit capabilities of central-processing-unit hardware so as to avoid locks. Once locks are eliminated, it becomes possible to realize the other attributes mentioned in the first sentence. In addition to the abovementioned attributes, this program offers several advantages over other RCP programs that use locks: It is smaller (and, hence, is faster and uses less memory), it is immune to priority inversion, and there is no way for it to cause a C++ exception.

This program was written by William Reinholtz of Caltech for NASA's Jet Propulsion Laboratory.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Refer to NPO-41196, volume and number of this NASA Tech Briefs *issue, and the page number.*

C Namelist Facility

C Namelist Facility (CNL) is a package of software that supports the development of data-driven programs that utilize relatively free-form input files (e.g., text files) to control complex operations. The only comparable prior namelist facility is built into Fortran and does not support arrays or records. Newer computing languages, including C and Pascal, do not include built-in namelist facilities. A namelist facility enables a program to utilize relatively free-form input files that contain assignment statements that give values to variables. Variables to which values are not assigned in input files remain unchanged; therefore, it becomes possible to have default values set by static or dynamic initialization of values prior to namelist input and updating of values is optional. Because it is not required to include values of variables in namelist input files, new parameters can be added to evolving programs without rendering old namelist input files obsolete — provided that the new parameters have useful default values. It should be possible to execute CNL in any operating system that supports the ANSI C programming language. It has been executed in several variants of Unix and in VxWorks.

This program was written by Bruce Bon of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-40087.

Efficient Mosaicking of Spitzer Space Telescope Images

A parallel version of the MOPEX software, which generates mosaics of infrared astronomical images acquired by the Spitzer Space Telescope, extends the capabilities of the prior serial version. In the parallel version, both the input image space and the output mosaic space are divided among the available parallel processors. This is the only software that performs the point-source detection and the rejection of spurious imaging effects of cosmic rays required by Spitzer scientists. This software includes components that implement outlier-detection algorithms that can be fine-tuned for a particular set of image data by use of a number of adjustable parameters.

This software has been used to construct a mosaic of the Spitzer Infrared Array Camera Shallow Survey, which comprises more than 17,000 exposures in four wavelength bands from 3.6 to 8 μm and spans a solid angle of about 9 square degrees. When this software was executed on 32 nodes of the 1,024-processor Cosmos cluster computer at NASA's Jet Propulsion Laboratory, a speedup of 8.3 was achieved over the serial version of MOPEX. The performance is expected to improve dramatically once a true parallel file system is installed on Cosmos.

This program was written by Joseph Jacob, David Makovoz, and Peter Eisenhardt of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-42860.